(5) Program the test sampler to conduct a single sampling run of 4 continuous hours. During the 4-hour sampling run, measure and record the radiant flux, ambient temperature, and filter temperature (all filter temperatures for sequential samplers) at intervals not to exceed 5 minutes.

(6) At the completion of the 4-hour sampling phase, terminate the sample period, if not terminated automatically by the sampler. Continue to measure and record the radiant flux, ambient temperature, and filter temperature or temperatures for 4 additional hours at intervals not to exceed 5 minutes. At the completion of the 4-hour post-sampling period, discontinue the measurements and turn off the solar source.

(7) Download all archived sampler data from the test run.

(g) *Test results.* Chamber radiant flux control. Examine the continuous record of the chamber radiant flux and verify that the flux met the requirements specified in table E–2 of this subpart at all times during the test. If not, the entire test is not valid and must be repeated.

(1) *Filter temperature measurement accuracy.* (i) For each 4-hour test period, calculate the absolute value of the difference between the mean filter temperature indicated by the sampler (active filter) and the mean filter temperature measured by the reference temperature sensor installed within 1 cm downstream of the (active) filter as:

*Equation 23*

$$T_{diff,filter} = |T_{ind,filter} - T_{ref,filter}|$$

where:

$T_{ind,filter}$ = mean filter temperature indicated by the test sampler, °C; and

$T_{ref,filter}$ = mean filter temperature measured by the reference temperature sensor, °C.

(ii) To successfully pass the indicated filter temperature accuracy test, the calculated difference between the measured means ($T_{diff,filter}$) must not exceed 2 °C for each 4-hour test period.

(2) *Ambient temperature measurement accuracy.* (i) For each 4-hour test period, calculate the absolute value of the difference between the mean ambient air temperature indicated by the test sampler and the mean ambient air temperature measured by the reference ambient air temperature recorder as:

*Equation 24*

$$T_{diff,ambient} = |T_{ind,ambient} - T_{ref,ambient}|$$

where:

$T_{ind,ambient}$ = mean ambient air temperature indicated by the test sampler, °C; and

$T_{ref,ambient}$ = mean ambient air temperature measured by the reference ambient air temperature recorder, °C.

(ii) To successfully pass the indicated ambient temperature accuracy test, the calculated difference between the measured means ($T_{diff,ambient}$) must not exceed 2 °C for each 4-hour test period.

(3) *Filter temperature control accuracy.* (i) For each temperature measurement interval over each 4-hour test period, calculate the difference between the filter temperature indicated by the reference temperature sensor and the ambient temperature indicated by the test sampler as:

*Equation 25*

$$T_{diff} = T_{ref,filter} - T_{ind,ambient}$$

(ii) Tabulate and inspect the calculated differences as a function of time. To successfully pass the indicated filter temperature control test, the calculated difference between the measured values must not exceed 5 °C for any consecutive intervals covering more than a 30–minute time period.

(iii) For sequential samplers, repeat the test calculations for each of the stored sequential sample filters. All stored filters must also meet the 5 °C temperature control test.

[62 FR 38799, July 18, 1997; 63 FR 7714, Feb. 17, 1998]

### § 53.58 Operational field precision and blank test.

(a) *Overview.* This test is intended to determine the operational precision of the candidate sampler during a minimum of 10 days of field operation, using three collocated test samplers. Measurements of $PM_{2.5}$ are made at a test site with all of the samplers and then compared to determine replicate

precision. Candidate sequential samplers are also subject to a test for possible deposition of particulate matter on inactive filters during a period of storage in the sampler. This procedure is applicable to both reference and equivalent methods. In the case of equivalent methods, this test may be combined and conducted concurrently with the comparability test for equivalent methods (described in subpart C of this part), using three reference method samplers collocated with three candidate equivalent method samplers and meeting the applicable site and other requirements of subpart C of this part.

(b) *Technical definition.* (1) Field precision is defined as the standard deviation or relative standard deviation of a set of $PM_{2.5}$ measurements obtained concurrently with three or more collocated samplers in actual ambient air field operation.

(2) Storage deposition is defined as the mass of material inadvertently deposited on a sample filter that is stored in a sequential sampler either prior to or subsequent to the active sample collection period.

(c) *Test site.* Any outdoor test site having $PM_{2.5}$ concentrations that are reasonably uniform over the test area and that meet the minimum level requirement of paragraph (g)(2) of this section is acceptable for this test.

(d) *Required facilities and equipment.* (1) An appropriate test site and suitable electrical power to accommodate three test samplers are required.

(2) Teflon sample filters, as specified in section 6 of 40 CFR part 50, appendix L, conditioned and preweighed as required by section 8 of 40 CFR part 50, appendix L, as needed for the test samples.

(e) *Test setup.* (1) Three identical test samplers shall be installed at the test site in their normal configuration for collecting $PM_{2.5}$ samples in accordance with the instructions in the associated manual referred to in §53.4(b)(3) and should be in accordance with applicable supplemental guidance provided in reference 3 in appendix A of this subpart. The test samplers' inlet openings shall be located at the same height above ground and between 2 and 4 meters apart horizontally. The samplers shall be arranged or oriented in a manner that will minimize the spatial and wind directional effects on sample collection of one sampler on any other sampler.

(2) Each test sampler shall be successfully leak checked, calibrated, and set up for normal operation in accordance with the instruction manual and with any applicable supplemental guidance provided in reference 3 in appendix A of this subpart.

(f) *Test procedure.* (1) Install a conditioned, preweighed filter in each test sampler and otherwise prepare each sampler for normal sample collection. Set identical sample collection start and stop times for each sampler. For sequential samplers, install a conditioned, preweighed specified filter in each available channel or station intended for automatic sequential sample filter collection (or at least 5 additional filters for magazine-type sequential samplers), as directed by the sampler's operation or instruction manual. Since the inactive sequential channels are used for the storage deposition part of the test, they may not be used to collect the active $PM_{2.5}$ test samples.

(2) Collect either a 24-hour or a 48-hour atmospheric $PM_{2.5}$ sample simultaneously with each of the three test samplers.

(3) Following sample collection, retrieve the collected sample from each sampler. For sequential samplers, retrieve the additional stored (blank, unsampled) filters after at least 5 days (120 hours) storage in the sampler if the active samples are 24-hour samples, or after at least 10 days (240 hours) if the active samples are 48-hour samples.

(4) Determine the measured $PM_{2.5}$ mass concentration for each sample in accordance with the applicable procedures prescribed for the candidate method in appendix L, 40 CFR part 50 of this chapter, in the associated manual referred to in §53.4(b)(3) and in accordance with supplemental guidance in reference 2 in appendix A of this subpart. For sequential samplers, also similarly determine the storage deposition as the net weight gain of each blank, unsampled filter after the 5–day (or 10–day) period of storage in the sampler.

(5) Repeat this procedure to obtain a total of 10 sets of any combination of

24-hour or 48-hour $PM_{2.5}$ measurements over 10 test periods. For sequential samplers, repeat the 5–day (or 10–day) storage test of additional blank filters once for a total of two sets of blank filters.

(g) *Calculations.* (1) Record the $PM_{2.5}$ concentration for each test sampler for each test period as $C_{i,j}$, where i is the sampler number (i = 1,2,3) and j is the test period (j = 1,2, . . . 10).

(2)(i) For each test period, calculate and record the average of the three measured $PM_{2.5}$ concentrations as $C_j$ where j is the test period:

*Equation 26*

$$C_{ave,j} = \frac{1}{3} x \sum_{i=1}^{3} C_{i,j}$$

(ii) If $C_{ave,j} < 10$ µg/m³ for any test period, data from that test period are unacceptable, and an additional sample collection set must be obtained to replace the unacceptable data.

(3)(i) Calculate and record the precision for each of the 10 test days as:

*Equation 27*

$$P_j = \sqrt{\frac{\sum_{i=1}^{3} C_{i,j}^2 - \frac{1}{3}\left(\sum_{i=1}^{3} C_{i,j}\right)^2}{2}}$$

(ii) If $C_{ave,j}$ is below 40 µg/m³ for 24-hour measurements or below 30 µg/m³ for 48-hour measurements; or

*Equation 28*

$$RP_j = 100\% \text{ x } \frac{1}{C_{ave,j}} \sqrt{\frac{\sum_{i=1}^{3} C_{i,j}^2 - \frac{1}{3}\left(\sum_{i=1}^{3} C_{i,j}\right)^2}{2}}$$

(iii) If $C_{ave,j}$ is above 40 µg/m³ for 24-hour measurements or above 30 µg/m³ for 48-hour measurements.

(h) *Test results.* (1) The candidate method passes the precision test if all 10 $P_j$ or $RP_j$ values meet the specifications in table E–1 of this subpart.

(2) The candidate sequential sampler passes the blank filter storage deposition test if the average net storage deposition weight gain of each set of blank filters (total of the net weight gain of each blank filter divided by the number of filters in the set) from each test sampler (six sets in all) is less than 50 µg.

### § 53.59 Aerosol transport test for Class I equivalent method samplers.

(a) *Overview.* This test is intended to verify adequate aerosol transport through any modified or air flow splitting components that may be used in a Class I candidate equivalent method sampler such as may be necessary to achieve sequential sampling capability. This test is applicable to all Class I candidate samplers in which the aerosol flow path (the flow path through which sample air passes upstream of sample collection filter) differs from that specified for reference method samplers as specified in 40 CFR part 50, appendix L. The test requirements and performance specifications for this test are summarized in table E–1 of this subpart.

(b) *Technical definitions.* (1) Aerosol transport is the percentage of a laboratory challenge aerosol which penetrates to the active sample filter of the candidate equivalent method sampler.

(2) The active sample filter is the exclusive filter through which sample air is flowing during performance of this test.

(3) A no-flow filter is a sample filter through which no sample air is intended to flow during performance of this test.

(4) A channel is any of two or more flow paths that the aerosol may take, only one of which may be active at a time.

(5) An added component is any physical part of the sampler which is different in some way from that specified for a reference method sampler in 40 CFR part 50, appendix L, such as a device or means to allow or cause the aerosol to be routed to one of several channels.

(c) *Required facilities and test equipment.* (1) Aerosol generation system, as specified in §53.62(c)(2).

(2) Aerosol delivery system, as specified in §53.64(c)(2).

(3) Particle size verification equipment, as specified in §53.62(c)(3).